Medicaid: Anticipating Costs for an Uncertain Future

An Honors Thesis (HONRS 499)

by

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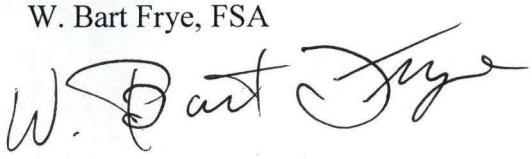

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Abstract

Created in 1965 to provide health care for the poor, Medicaid today is the largest medical coverage provider of any social or private insurance program in the United States. As both enrollment increases and cost growth outpaces income growth yearly, Medicaid is an increasingly costly program that is one of the top budgeting obligations for both the federal and state governments. This program's role in society is expected to only grow further as one of the primary vehicles for providing health coverage to the uninsured under recent health reform. With the importance of Medicaid's future in mind, many forecasts of its costs for the next ten or twenty years have been made, and the study of these forecasts renders the data, assumptions, and methods employed to produce them. Understanding these choices is essential for being able to create my own forecast model and expect reasonable results. Applying data for two states, Massachusetts and California, to this model enables a broader comprehension of Medicaid's outlook as the program progresses uniquely in each state. Predicting costs in the future with a high degree of accuracy is inherently difficult to do. Despite this, the results from this type of work give a perspective on what could be expected if trends today continue in the future.

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I wish to extend my appreciation to Professor Frye for his insight, patience, and dedication as my advisor in this endeavor. I owe a great deal of the actuarial knowledge I have acquired in my time at Ball State University to him.

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Medicaid: Anticipating Costs for an Uncertain Future

Introduction

Today, the majority of medical bills are not paid directly by the one receiving care but by a second party. One of the major payers is a program set up by the government in 1965 called Medicaid, a social program intended to provide qualifying low-income families with health care coverage. In 2007, the program covered services for nearly 60 million people; in 2008, spending amounted to $339 billion. Now, Medicaid is the largest coverage provider of any social or private insurance program in the United States. As both enrollment increases and cost growth outpaces income growth yearly, Medicaid is an increasingly costly program that is one of the top budgeting obligations for both the federal and state governments. Additionally, under the recent Patient Protection and Affordable Care Act (PPACA) requirements for enrollment to the Medicaid program will be altered, making it a vehicle for covering many of the currently uninsured in this nation (Kaiser).

Given the size of this governmentally funded program and the likelihood of its expansion in the years to come, estimating the future costs to be incurred is an important study. Estimates of these future costs, sometimes called forecasts or projections, have been done by actuaries for both state governments and the federal government. The Mathematical Sciences department at Ball State University has done such analysis in past years using state-by-state data for Medicaid enrollment and costs to forecast expected costs into the future. Much of the paper is devoted to the study of this process as projections done by various groups are analyzed to pull out differences in data sources, modeling equations, and assumptions pertaining to the future.

Afterwards, I discuss the model I constructed on the basis of this research to create a projection for a state's Medicaid program through 2030. This was done to understand further the science behind and limitations of creating a long term projection. Data for the Massachusetts and California Medicaid programs were applied separately. This gave way to some interesting discussion of demographic and policy differences between the two states. In the end, I have given some consideration to how the program will be changed by the PPACA and the impact this may have on future costs. Having no historic data for changes yet to take effect makes accurately projecting inherently difficult. Therefore, my main purpose in approaching this study is to understand and explain how actuaries assign estimate values to variables that are unknown in an ever-changing world. Given recent reform, the health care industry is an excellent setting for this study, and I believe the result of possible outcomes for the Medicaid program is an important discussion to be had.

Actuaries are very involved in valuing what amount future obligations will cost the one making the promise. In the insurance industry, companies receive premiums and in return promise to pay varying amounts in the event of a house fire, auto accident, or death to name a few. What all these events have in common is their uncertainty, whether that is the severity of an event, the timing of the event, or the likelihood of the event even occurring. Similarly, the government has in place social programs that make promises to its citizens. With Social Security, retirement age citizens are given checks every month providing income so long as they live. With Medicare and Medicaid, citizens belonging to certain demographic groups in society who enroll in the programs are provided coverage for health care services in the event the services are needed. Actuaries rely heavily upon data of past experience pertaining to these events to predict with as much accuracy as possible what is uncertain. The results can then be used to value the

cost of the promised coverage in the years to come. Likewise, this has been done by various entities for the Medicaid program and is the subject of this paper.

The Medicaid Program

A fundamental understanding of the purpose and structure of Medicaid is required in order to be able to understand what is going on behind the forthcoming large estimated values. This will be carried out by a brief history lesson of the forty-five year old program, including an overview of its unique structure. Consideration is given to the purpose Medicaid serves as well, and how this purpose will give the program greater responsibility in the years to come. Hopefully, the case is made here that projecting the future costs of the Medicaid program is a significant endeavor.

The Medicaid program started as part of legislation signed into law by President Lyndon B. Johnson known as the Social Security Amendments of 1965. Another health insurance program established along with it was Medicare with its aim of providing coverage for the aged. Medicare received much press and was deemed controversial being seen as an attempt to "socialize medicine." Thus, Medicaid began with little attention from the public, and it became "the sleeper" of the programs established through this landmark legislation of 1965 (Introduction xiii). The original intent of it was to supply only those already on the welfare system with health care (Kaiser 1).

This purpose may have seemed inconsequential in view of supplying insurance for the whole aged population, Medicare. Also, Medicaid was believed to be for the short term until a national health insurance program would be established in five years. However, that program never came to be and Medicaid was around and growing at the time of the writing of the book this information is coming from, as it is today. *The Medicaid Experience* cites the program's first year of implementation, 1970, to have cost an estimated $238 million, well over what was

anticipated at the time of passing due to many unexpected enrollees who met the eligibility criteria. The book, written in 1979, goes on to share an estimate of the program coming to cost $20 billion a year (Introduction 1). As stated at the beginning of this paper, the program cost $339 billion in 2008. Evidently, a story of unprecedented growth continues in Medicaid today.

Overall growth in health care costs and an increasing general population have contributed to this trend, but it has been due in large part to government expansion of coverage by the federal government and state governments. Each state is responsible for administering its own Medicaid program with matching of funding by the federal government. This is known as the Federal Matching Assistance Percentage (FMAP) and varies by state depending on its demographics and size of program. Federal regulations are applied to every state that must be met, but beyond these minimum requirements states are given freedom to determine levels of eligibility categorically and based on income. Eligibility categories include children, foster children, parents, childless adults, unemployed, blind, aged, and disabled, etc. Many groups are also only eligible up to a certain income level such as 133% of the Federal Poverty Level (FPL). With options for administering Medicaid and for setting the degree of eligibility, the program has become very diverse state to state (Rymer et al.).

According to another text, this federal-state structured program was created hastily as an afterthought to Medicare in order to sop up state funds that would go unused once federally funded Medicare took responsibility for the aged. Therefore, few cost estimates or serious studies of the program's implications were done, which concurs with the view of Medicaid being a "sleeper" (Grannemann 5).

This view of the program being ill-planned puts forth the question of why should we keep it, especially as costs will continue to rise in the future? If its aim is to help the poor then the most effective and straightforward tool would be to redistribute income to individuals with low income to finance their own health care. Instead, administering one program with extensive coverage to pay health expenses for every member of this group adds a heavy cost burden, argue the authors of *Controlling Medicaid Costs*.

However, if small, additional incomes were given up front instead, many would purchase insurance with less coverage than Medicaid and others would refrain from getting insurance at all. Therefore, the country would still have individuals receiving health care that other users are paying for and overall health care costs would go down, but those unwilling to pay would be denied care by hospitals and doctors. This result would be unsatisfactory due to positive externalities for the poor to receive needed medical care. A positive externality is a benefit from an economic exchange that goes to a party not participating in the trade.

In this case, the party is United States tax payers. Some of the externalities are guided by self-interest: making health services available prevents the spread of contagious diseases and keeps individuals from being unable to work. However, the case is made that the primary benefit is altruistic. For this reason, we have the Medicaid program because taxpayers desire to provide health coverage for individuals who would not pay for it themselves if they were given the income to do so. The benefit that taxpayers in some states derive from this is higher than those in others. That is why, given the choice, states have developed programs with differing depths of coverage (Grannemann). This will help to explain differences between the Massachusetts and California programs, which will both be discussed later on.

On the basis of its benefits brought forth in *Controlling Medicaid* Costs, the future of the Medicaid program is a relevant study now, even if not at its inception. *Medicaid: A Primer* published by the Kaiser Family Foundation affirms its usefulness, citing from surveys that Americans, by majority, believe the program is very important, many having received its benefits or had a family member who had. Also, experience was highly satisfactory for both affordability and breadth of coverage (Kaiser 11). This study of the program's future also ought to be done at the state level given underlying differences by state for reasons that have been referenced.

If the purpose of this paper is to assign estimates to the future of Medicaid, then some discussion of recent health reform's impending effects upon the program seems essential. This must be prefaced, however, with an explanation of the limitations in projecting which will come up later. Since historical data is a primary component of any projection, a significant change such as one caused by legislation is inherently difficult to project, and therefore, forecasts often must hold the assumption that no legislative changes will be made to the program's services and eligibility for the duration of the forecast. In spite of this requisite and perhaps naïve assumption applied to the work of forecasting, recent legislative changes to Medicaid that are currently set to take effect need to be laid out.

Just as the Social Security Amendments passed in 1965 were a source of much debate and controversy, health care reform created through the Patient Protection and Affordable Care Act (PPACA) passed in March of this year by President Barack Obama has captivated much of the nation's political attention. Its primary intention is to significantly reduce the population of uninsured citizens through several new and altered government programs and requirements. Under the PPACA, Medicaid will be expanded to cover a significant portion of this currently ineligible and uninsured population. Taking effect in 2014, this will be caused by a federal

requirement for states to set eligibility to 133% FPL for nearly all individuals under age 65. This will bring into the program the population of poorer adults without children who are currently categorically excluded at any income level for most states. Any enrollment expansion that states experience as a result of this will be primarily funded by the federal government through a higher FMAP than what is applied to the program's costs due to current enrollment groups. Also, procedures will be implemented to simplify the process of enrolling which the present laboriousness of keeps eligibles out. Access to physician care will be increased by raising the Medicaid compensation rates to Medicare levels (Kaiser 30-31).

The estimated impact to Medicaid from eligibility expansion and increased enrollment due to the overall effects of the health reform will be an increase of 16 million individuals to the program by 2019. The cost coming from increased coverage in 2014 through 2019 will be $464 billion. These estimates have been broken down by state as well and will prove useful in the discussion later of two state projections completed for this paper (Holahan 2).

Anticipating the future costs of a program such as Medicaid is difficult to do with any degree of certainty based on how it has grown unexpectedly in the past, and the unpredictability seems to be prescribed for the future in light of the amount of recent legislation. Yet, this program with perceived societal good demands it in order for taxpayers to have an anticipation of the direction the program is heading. This will be best served working with numbers at the state level given a high level of variance between states due to the structure of financing and administering Medicaid.

Medicaid Forecasting Data, Methods, and Assumptions

With a foundation of the Medicaid program's purpose and structure established, the question of how to determine the program's future costs can now be addressed. In order to understand the processes and reasons for creating Medicaid projections, analysis of reports previously done by various groups with different reasons for having their own projections of the program is important. Therefore, I detail the methodology and intent from reports done for various states' programs as well as a forecast of the entire nation's Medicaid program done by the Office of the Actuary. From the data sources and methods used in these reports, I was able to build my own model for state Medicaid programs.

Medicaid projections are often made at the state level because each state is a major player in financing its own program due to the Medicaid's federal-state nature as discussed earlier, and therefore the subject is of great significance to the state's budgeting committee. For most states, funding Medicaid is their largest expense except for primary and secondary education.

State of Nebraska Projection

In 2005, the state of Nebraska made changes to its program in an effort to provide medical care for more Nebraskans in certain low-income groups who cannot pay for it themselves while addressing the rate of growth in expenditures. The reform included requiring the state's Department of Health and Human Services (DHHS) to conduct a biennial summary and analysis of the program's current status in years going forward, to be provided to Nebraska legislator and the public.

An integral part of this analysis involves a twenty year projection from 2005 to 2025. Each time a new summary is made this projection is adjusted to account for new data of

enrollment and costs. One purpose this serves is to compare the expected costs for each year through 2025 to the proportion of the state's General Fund currently planned to be allocated to Medicaid for each year. When originally done in 2005, DHHS estimated that by 2025, Nebraska would have a $785 million shortfall for Medicaid funding. However, when the projection was reevaluated three years later with most recent data, the estimated shortfall for 2025 would be $368 million, less than half the prior estimate. This illustrates the difficulty in capturing such future outcomes having a twenty year window with any degree of certainty. Again, the intent of such projections is to give an idea of where large programs such as Medicaid are headed, not an exact figure.

The process used to develop this overall cost projection was the product of two separate projections: the average monthly number of individuals eligible for Medicaid and the average cost for a month of eligibility in Medicaid. This was done on a monthly basis and then multiplied by twelve rendering an annual figure because participation in the Medicaid program is considered on a monthly basis and enrollment has a high turnover.

The first factor is comprised of the state's fiscal year 2005 average monthly number of Medicaid eligibles and a Nebraska population by age projection made by the Center of Public Affairs Research at the University of Nebraska at Omaha. Applying the state population projection to eligibles data for one year assumes that the percentage of the population's enrollment for each age group remains constant for years going forward. This is one reason that projections often assume that no changes are made in legislation from the historical data used. Otherwise, the enrollment percentages held constant would likely change to some unknown value. The one year of Medicaid eligibles data acts as a baseline that growth rates from the population projection are applied to.

The second factor to the overall projection is the actual growth in average monthly cost per eligible in Nebraska Medicaid from 2000-2005 data, averaged with projections made for increases in the cost for health care from 2006 to 2014 by the Office of the Actuary at the Centers for Medicare and Medicaid Services (CMS). The baseline data for the costs per month used is unclear; presumably it would be 2005, the final year with data. For the cost per month growth rate, results from the state program's data are blended with national rates.

In the end, these two factors, growth in average monthly number of eligibles and growth in monthly cost per eligible, were multiplied together for each year of the projection. Since the intended audience was at the state government level, a factor of 40% was applied to the resulting values to give the state's own Medicaid cost burden.

State of Alaska Projection

Similarly to Nebraska, the Alaska State Legislature and Alaska's DHSS took steps in 2005 to have a projection of the state's Medicaid program made. In this case, they requested that third party consultants The Lewin Group and ECONorthwest create a twenty year forecast which has been redone each year since to reflect the program's most recent year of experience. The purpose was not to focus on specific values, but from the results, to provide approximations of the rates for growth in enrollment and costs. Like with other projections, this one does not account for future changes in legislation that would alter the current mixture of services and eligibility groups.

Much like the national projection to be discussed made by CMS, this model considers three main factors of growth: program enrollment, service utilization, and medical price inflation. The enrollment factor is primarily driven by a statewide population forecast made by

the Alaska Department of Labor and Workforce Development and is then broken down demographically in relation to the state's historical enrollment data. Categories given were sex, age group (child/working age/elderly), native/non-native, and geographical region of the state. Residency status was primarily considered for the purpose of determining Alaska's individual cost burden since the projection was produced at the state level. The purpose for these many categories was to capture large differences in eligibility for and consumption of services between these subgroups. Using eight years of historical data, the modelers could create coefficient estimates for each of these variables to predict enrollment through 2025 using regression equations.

The second two factors, utilization and inflation, considered together give a growth rate of total claims spending. For utilization, logistic regression models of historic claims data at the enrollee level, adjusted for inflation to 2004, were used to estimate the probability an individual enrollee, given her demographics, will utilize a given service of Medicaid in a single year. Then using a linear regression model by service category, the total spending per enrollee could be projected through 2025. For the inflation, the modelers chose a nationally accepted medical rate of inflation to apply to the aforementioned projected values.

Med-Cal Expenditures: Historical Growth and Long Term Forecasts

As with the other Medicaid state program projections studied in this paper, a forecast was published by the state of California in 2005 for their Medicaid program Medi-Cal looking ahead ten years. All these studies seem to have been initiated around the same point as a result of the federal government considering shifting more of the cost burden to the states at the time. At the request of the California Health and Human Services Agency (CHHSA) to assist state legislator

in policy decisions, the Public Policy Institute of California (PPIC) produced this analysis. When the study was published Medi-Cal cost a total of $33 billion annually, making it one of the largest state Medicaid programs and California's portion of the expense took up fifteen percent of the state's general budget.

The PPIC considered the two main cost drivers of the program to be enrollment growth and increasing expenditures per enrollee. Again, this projection does not give consideration to future policy changes, assuming the program's current structure is maintained throughout the forecast. The assumption is also made that the average expenditures per enrollee broken down by service category rates of growth will be the same as the ones projected by the Centers for Medicare and Medicaid Services (CMS) for the National Health Expenditure (NHE) Accounts. PPIC also manipulated the expenditure rates to provide scenarios for somewhat lower and somewhat higher rates of growth. They chose not to adjust the results for predicted inflation, so as to keep the values expressed in year 2003 dollars; 2003 is the base year of the projection.

In creating the projection model, California claims data from the '35' Paid Claims File for years 1997 through 2003 was broken down by six health service categories and six groups of enrollment. Eligibility data retrieved from the Medi-Cal Eligibility Data System, an online system that monitors enrollment in the program, was broken down by the six groups (disabled children, non-disabled children, disabled adults, non-disabled adults, disabled aged, non-disabled aged) as well. A population projection through 2015 made by the California Department of Finance was divided into the three age groups. Known as a baseline model, this breakdown of data will create an expenditure table for any given point in time. The following is Table B.1 taken from the report to illustrate this point.

Service j / Enrollee k		Service Categories				
		1	2	...	J	Total
Enrollee Type	1	Y_{11}	Y_{12}	...	Y_{1J}	$Y_{1\cdot}$
	2	Y_{21}	Y_{22}	...	Y_{2J}	$Y_{2\cdot}$
	...	...	...	...	...	...
	K	Y_{K1}	Y_{K2}	...	Y_{KJ}	$Y_{K\cdot}$
Total		$Y_{\cdot 1}$	$Y_{\cdot 2}$	...	$Y_{\cdot J}$	Y

Each Y_{kj} equals the total expenditure on service j for all enrollees of type k. From this, the proportion spent on a certain service type against the total expenditure for each enrollee group can be determined as well as the proportion an enrollee group relative to all enrollees spent on a particular service. Both are very helpful for determining a more precise forecast. For instance, the service category for hospital care may be expected to grow faster relative to the others. With data in this table format, the enrollee group impacted the most by hospital care expenditures can be determined.

PPIC determined that the two cost drivers are the growth rate in enrollment per year, $n_{kj}(t)$ using their notation, and the growth rate in cost per enrollee for a year or $a_{kj}(t)$. The last can be broken down further into the rates of price growth and quantity consumption growth. However, the combined rate of cost per enrollee was only studied for simplicity. This results in the following equation for overall growth rate:

$$y_{kj}(t) = n_{kj}(t) + a_{kj}(t)$$

With dollar-value cost data listed out in the discussed table format for the year prior to the first year of the forecast, growth rates specific to age group taken from the population projection could be applied to each appropriate cell and growth rates specific to service type taken from CMS/NHE could be applied to each appropriate cell. Put mathematically, the next-year estimated total expenditure for enrollment group *k* and service type *j* or $Y_{kj}(t)$ is found by the equation:

$$Y_{kj}(t) = Y_{kj}(t\text{-}1) * (1 + y_{kj}(t)\ )\ ^{1}$$

The baseline projection applies this concept for each through 2015. The individual total expenditures by enrollee group and service type then may be summed to provide the overall projected expenditure by year.

CMS National Medicaid Forecast

In 2008, the Office of the Actuary (OACT) at the Centers for Medicare and Medicaid (CMS), the office which administers Medicaid for the federal government, was asked to prepare an analysis of past financial trends in the Medicaid program as a whole nation and to create a ten year projection for the program. Seven percent of the entire federal budget was spent on Medicaid in the previous year, which amounted to $190.6 billion. Thus, conducting an analysis of the program at the federal level was a significant endeavor.

The OACT pulled their data from two sources, one being the Medicaid Statistical Information System (MSIS) which includes service and demographic specific information about payments to providers and enrollment supplied by the states. The other source is quarterly reports submitted by the states informing current expenditures and then 2-year spending by

[1] The equation which appeared in the source is instead $Y_{kj}(t) = Y_{kj}(t\text{-}1) * y_{kj}(t)$. However, I found this alteration to be more accurate since $y_{kj}(t)$ is a rate.

service forecasts, known as CMS-64 and CMS-37 respectively. The OACT adjusted data from both sources described to make them cohesive for preparing the projection. Assumptions made by the Boards of Trustees of Social Security and Medicare for economic, demographic, and price trends were adapted in this projection.

The report explains a health actuary's typical method for estimating expenditures. It is the product of the number of program enrollees, also known as the "caseload" (C), the quantity of services each person uses, often termed "utilization" (U), and the price charged for each unit of service (P). Expressed mathematically this is simply

$$E = C \times U \times P$$

The issue in using this equation is that Medicaid data for utilization and reimbursement rates were unavailable to the OACT. Therefore, a modification was made to the formula rendering

$$E_{y+1} = E_y \times (1 + c_{y+1}) \times (1 + u_{y+1}) \times (1 + p_{y+1})$$

where c_{y+1}, u_{y+1}, and p_{y+1} are each growth factors in year $y+1$ applied to total expenditures for the previous year or base year y to result in an estimated total expenditure for year $y+1$. The first growth factor, the factor for caseload, is determined by trend analysis of Medicaid enrollment data (MSIS). The second factor utilization is thought of as making up the difference between total growth and the growth due to enrollment and price changes, which are characterized by c_y and p_y. The utilization growth rate was determined by an analysis of the historical relationship between growth in expenditures, caseloads, and the price factor. Values for the last growth factor, price changes, were derived from forecasts produced for the 2008 Medicare Trustees Report. Each of these rates was broken down further by service type and eligibility category.

Using the described process, the OACT predicted that the Medicaid program would reach $673.7 billion by FY 2017 with an average spending increase of 7.9 percent over the ten year course of the projection.

Ball State Mathematical Science Department

The Department of Mathematical Sciences at Ball State University under the guidance of Professor W. Bart Frye, FSA and input by the Medicaid Work Group of the American Academy of Actuaries, developed a state-by-state projection for twenty-five years beginning in 2005. The work completed through this effort was my primary source for guidance in creating a model which I will discuss in the next section. Eligibility data broken down by age/sex/service category/eligibility group from 1999 through 2004 was taken from MSIS similar to that mentioned in the CMS national forecast. This is stored in the monthly CMS Datacubes provided by each state's program and stored online. The cost data was likewise pulled from the quarterly CMS Datacubes for the same years and fields. Population projections created by the US Census Bureau were used as well.

With this data a process was followed to create the projection. First, a weighted average of the total months of eligibility per person for one year was determined using the total months of eligibility divided by the total state population for each of the six years of data. Individual values were found by particular age, sex, service category, and eligibility group. These weighted averages were then multiplied by the projected population in each year going forward to render the "Total Months of Eligibility" for that year giving projected values throughout the course of the projection period.

Afterwards, a similar process was followed to find the weighted average "Cost per Month of Eligibility" by dividing the total cost by the total months of eligibility for each group in each year of the data. Multiplying this weighted average for each group by a selected growth factor gave the projected "Cost per Month of Eligibility" for each year. While not discussed in this work, regressions of data were used to try to determine unique growth factors pertaining to the type of service. Otherwise, a standard three percent rate of inflation was assumed. Lastly, multiplying the corresponding "Total Months of Eligibility" and "Cost per Month of Eligibility" for each group and year resulted in the total cost for the group and year which could be summed to give projected total costs for years 2005 through 2030 of the state's Medicaid program.

Reviewing Medicaid projections created by various groups of experts is essential for reinforcing and challenging the understanding of how to proceed in creating a new forecast with the intention of utilizing best practices. While much of the work done by the group from Ball State was applied to the process used for this work, the next section points out the use of data, methods, and assumptions from the other projections discussed as well.

Creating a Model

To better understand the process for creating a forecast of a health program such as Medicaid, I sought to create my own model. Because of the federal-state structure of the program and volume of eligibility and claims data, projecting the future of the program for two states became my scope. I chose two states with different policies for eligibility, demographics, and state program size: Massachusetts and California. This ideally will prove relevant to the discussion of the Medicaid program's future in light of health reform. Since Massachusetts already provides coverage for the population that is to be captured by the Patient Protection and Affordable Care Act's (PPACA) provision for Medicaid eligibility expansion, a projection of its costs may have some implications for other programs that do not currently cover this population but will soon be required to, one of which is California. As stated by the projection from 2005 of Medi-Cal, California's Medicaid, the program is one of the largest in the nation by volume. Therefore, any legislative change will be magnified compared to the other states. Before analyzing the projections constructed for these two states, the data, methods, and assumptions used to construct the model are explained.

As with the projections created by Ball State's Mathematics department, eligibility data was taken from the Medical Statistical Information System (MSIS) using the monthly Center for Medicare and Medicaid Services Datacubes online. Likewise, cost data was taken from the quarterly Datacubes. Differences in the cost and eligibility data from the preceding model are data from 1999 through 2008, the most recent available year, is included and the field for service types is excluded. The second choice was due to a simplifying assumption of one standard rate of cost growth rendering distinction by type of service provided unnecessary. The MSIS was also a source of data chosen for the CMS national projection done by the Office of the Actuary.

The data source for population projections was the same as what the department had used too. The US Census Bureau published an "Interim Population Projections for States by Age and Sex: 2004 to 2030" in March of 2004. The data from the 2000 Census was used as a base to project from, and small adjustments were made to projected years 2001, 2002, and 2003 based on estimates which then impacted the following years in the actual projection. Then, anticipated rates for fertility, survival, and internal migration were compiled to make the state population projections. Many of the other forecasts used population projections to help determine growth in enrollment. Alaska, for instance, relied upon a projection made by one of the state's departments which was able to estimate changes by county, a relevant feature for the purposes of that projection.

The first step was to compile the nine years of eligibles data into one file and the costs data into another. Eligibility groups were used similar to that described in the Medi-Cal projection. They are adults, children, aged, and blind/disabled with two subgroups each for male and female giving eight groups. The cells were separated further by eleven age groups resulting in eighty-eight cells set up in a table much like the diagram shown under the Medi-Cal projection where each Y value is a number of enrollment months or yearly costs.

Enrollee j / Age k		Enrollee Type (Category and Sex)				
		1	2	...	J	Total
Age Group	1	Y_{11}	Y_{12}	...	Y_{1J}	$Y_{1\cdot}$
	2	Y_{21}	Y_{22}	...	Y_{2J}	$Y_{2\cdot}$
	...	...	...	...	...	...
	K	Y_{K1}	Y_{K2}	...	Y_{KJ}	$Y_{K\cdot}$
Total		$Y_{\cdot 1}$	$Y_{\cdot 2}$	...	$Y_{\cdot J}$	Y

The Nebraska forecast explained that enrollment in the Medicaid program is determined on a monthly basis and experiences a high degree of churning. I sought to account for that in my model. The eligibility data provides enrollment numbers for each month of the year, and so I summed these months giving a value for total months of eligibility in each of the eighty-eight cells. This is more accurate than using the total enrolled in a year multiplied by a factor of twelve because many individuals are only actually enrolled for a few of the months of the year and not all twelve.

Each of these total months of eligibility (E) was divided by the states population (P) for the corresponding to give the average number of months enrolled by a citizen of the state (e) varying by age group.

$$e_{kj} = E_{kj} / P_{kj}$$

A weighted average was determined from these values, and it was then multiplied by the projected population for each year to give projected total months of eligibility. The average was

weighted using an assumption made by the Mathematics department. Given that legislative and economic changes have a large impact upon Medicaid, only a three-year look back ought to be considered relevant. Therefore, the most recent year of data was given 60% credibility, the year before that 30%, and the preceding year 10%.

$$e_{k,j}(\text{weighted avg}) = 0.6 * e_{k,j}(2008) + 0.3 * e_{k,j}(2007) + 0.1 * e_{k,j}(2006)$$

$$E_{k,j}(\text{projected year n}) = P_{k,j}(n) * e_{k,j}(\text{weighted avg})$$

Next, the cost data (Y) was divided by the total eligible months data (E) to give the average cost for a month of enrollment (y) depending on age and group. These values were adjusted for a standard 3% rate of inflation in order to be expressed in 2008 dollars, the base year.

$$y_{k,j} = Y_{k,j} / E_{k,j}$$

From this the weighted average cost per month was determined, and multiplied by a rate of cost growth (r) based on the Medical Consumer Price Index (CPI) specific to the state's region for each year out. The CPI is studied and regularly released by the Bureau of Labor Statistics representing a market basket of selected medical care services including physicians' services, hospital services, dental services, services by other medical professionals; and nursing homes and adult daycare. Medical services can differ greatly in the rate of change in price, and many of the forecasts studied attempted to account for this. However, that did not fit the scope of this work. The Medical CPI is a reasonable way of accounting for higher than standard inflation price growth for Medicaid services. The Alaskan forecast relies upon a nationally accepted inflation rate in accounting for price growth.

$$y_{k,j}(\text{projected year n}) = (1 + r)^n * y_{k,j}(\text{weighted avg})$$

With projected values for total eligible months and cost per eligible month, the corresponding cells for each could be simply multiplied to give the total cost by year per group age and type. The summation of these eighty-eight groups gives the overall anticipated cost for each projected year.

$$Y(n) = \sum^{11}_{k=1} \sum^{8}_{j=1} E_{k,j}(n) * y_{k,j}(n)$$

While expressed differently than the formulaic methods from the California and CMS forecasts, they are mathematically equivalent. Using algebra the above equation can be shown to simply be the base cost multiplied by rates of growth for enrollment and cost:

$$Y(n) = \sum^{11}_{k=1} \sum^{8}_{j=1} P_{k,j}(n)/P_{k,j} * E_{k,j} * y_{k,j}(n)$$

$$= \sum^{11}_{k=1} \sum^{8}_{j=1} \text{enrollment growth rate} * E_{k,j} * (1 + r)^n * y_{k,j}$$

$$= \sum^{11}_{k=1} \sum^{8}_{j=1} \text{enrollment growth rate} * \text{cost growth rate} * E_{k,j} * y_{k,j}$$

$$= \sum^{11}_{k=1} \sum^{8}_{j=1} \text{enrollment growth rate} * \text{cost growth rate} * Y_{k,j}$$

As was the case with the other forecasts, this model assumes a constant rate of enrollment for each group throughout the course of the projection. However, demographic changes in population such as an increased proportion of aged are accounted for. The assumption is also made that Medicaid legislation will remain congruent with that of the historical data, an obvious limitation given that health care reform has recently been passed.

Application of Two State Programs

With the model created, data for any state's Medicaid program can be imported to generate a forecast to anticipate the costs. In the scope of my thesis I was able to study two states with different programs: Massachusetts and California.

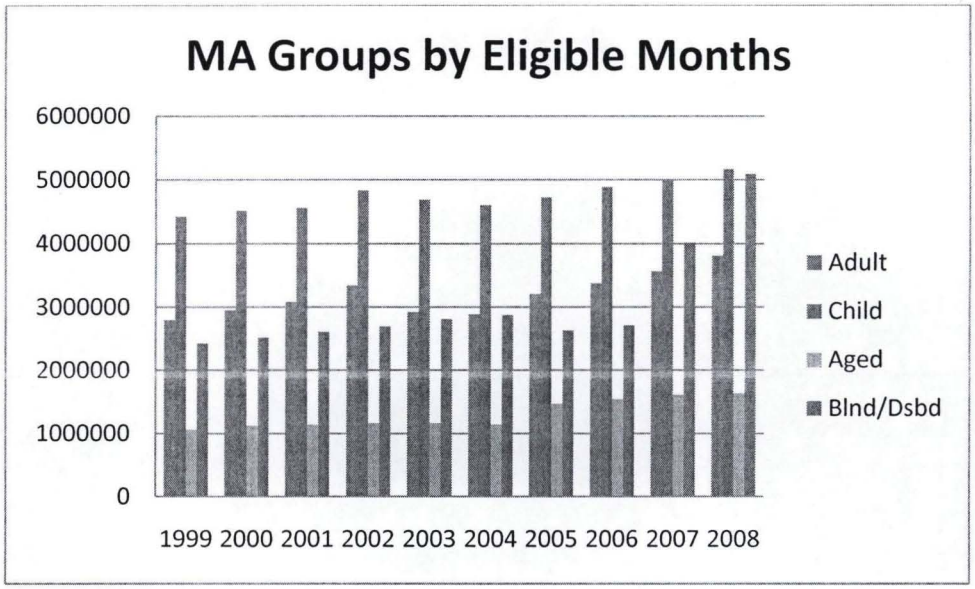
Massachusetts was chosen primarily because it fits the form of where the overall Medicaid program is heading so well. In fact, the Kaiser Family Foundation (KFF) has published two separate papers focusing on consumer satisfaction with the state's program and lessons to be learned from the state for making changes to Medicaid. It is one of seven states with what is known as a Section 1115 waiver program, by which the state covers low-income childless adults who are ineligible for the current Medicaid federal requirements. Since Massachusetts is already covering this group, the state government will actually experience savings as the federal government takes an increased role in funding the group.

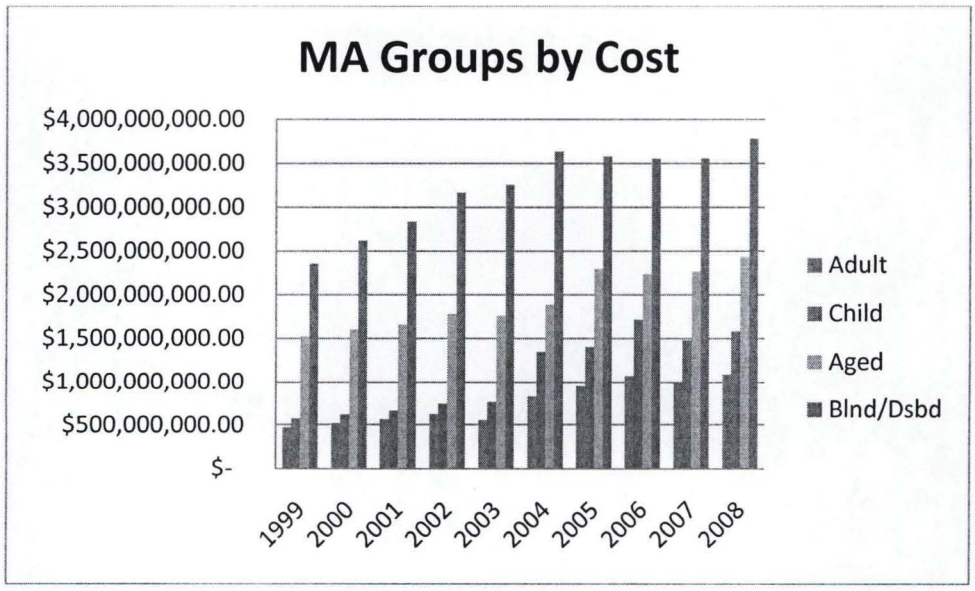
In a more recent work completed by the KFF, analysts estimated the impact the eligibility expansion to 133% FPL will have on each state. They created estimated based on two separate sets of assumptions, one with low rates of participation from the population and the other with high rates. In the low scenario, Massachusetts is expected to only see a 0.7% percent change in total spending and a 1.8% change in the high scenario through 2019. California, however, was estimated to have 12.3% increase in total spending in the low scenario and 15.8% increase in the high participation scenario. This is actually modest in comparison to most states, but given the size of the program already, an additional increase in the 12% to 15% range will have a large impact (Holahan).

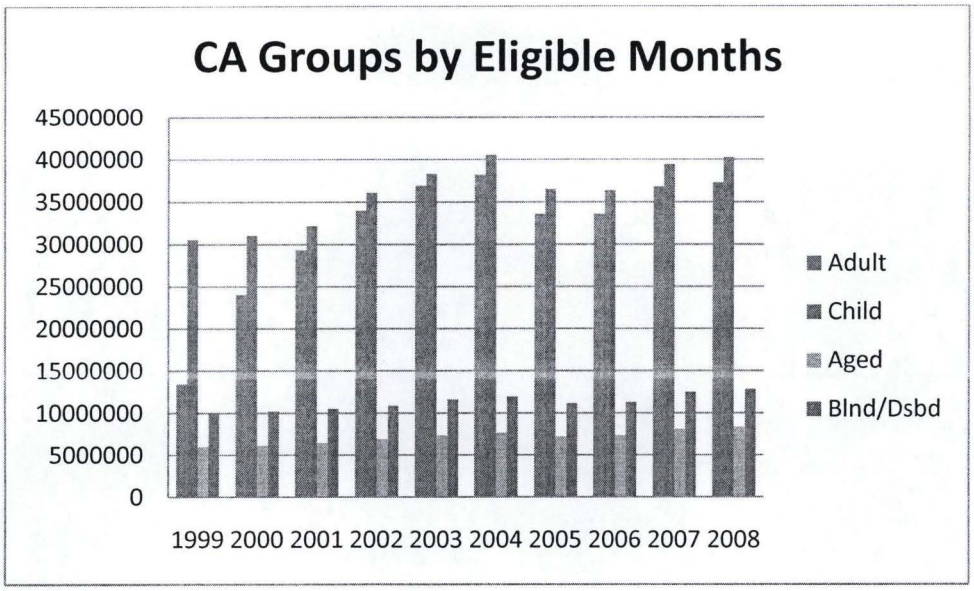
While the model I have created provides little ability to anticipate such coverage expansion, the projections to be discussed can be thought of a base projection from which the additional spending increases I have mentioned can be anticipated. For California's current cost growth rate, two different Medical CPIs were used and the results were averaged together. One was surveyed in the San Francisco, Oakland, and San Jose area while the other was in the Los Angeles, Riverside, and Orange County area. The resulting rate is 4.647%. Massachusetts's cost growth rate was taken from a Medical CPI survey of the Northeast region incorporating cities: Boston, Brockton, Nashua, and the states of Massachusetts, New Hampshire, Maine, and Connecticut. The resulting rate is 4.683%. The two are remarkably close.

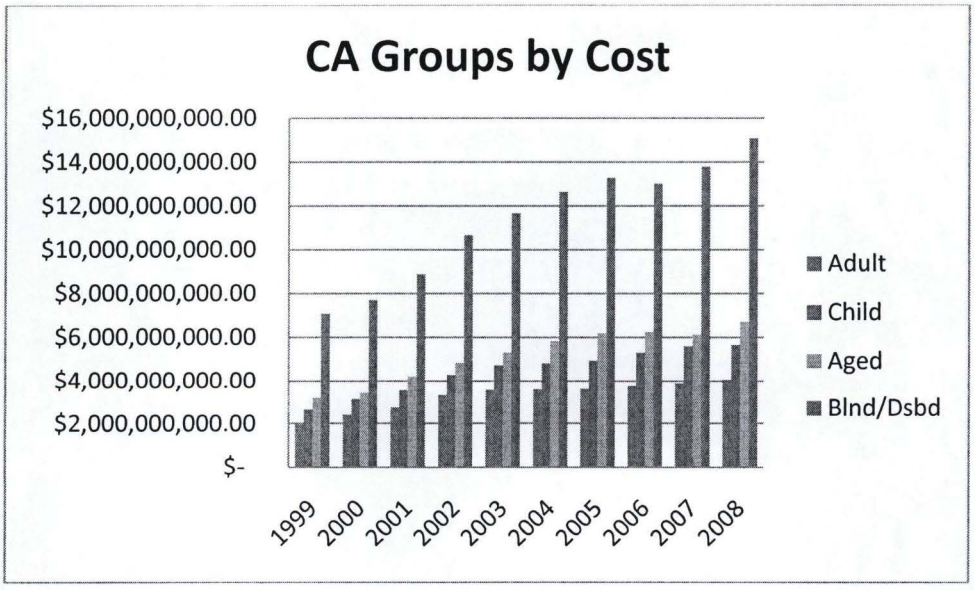
Using the state population projections from the US Census Bureau, California is found to have a 1.025% rate of growth yearly for the general population while Massachusetts has only a growth rate of 0.299%. While the two states show little difference in rate of cost growth, this difference in population growth will likely account for a much greater rate of growth for the Medicaid program in California.

The tables on the following two pages demonstrate the importance of separating Medicaid spending into categorical groups and applying unique population growth rates according to age. In Massachusetts and even more noticeably in California, child and adult enrollment is on average very high relative to the other two groups: the aged and blind/disabled. Despite this, the last two on average take up the most significant portions of the spending by far. Enrollment and spending for these two groups is shown for the ten years of historical data.

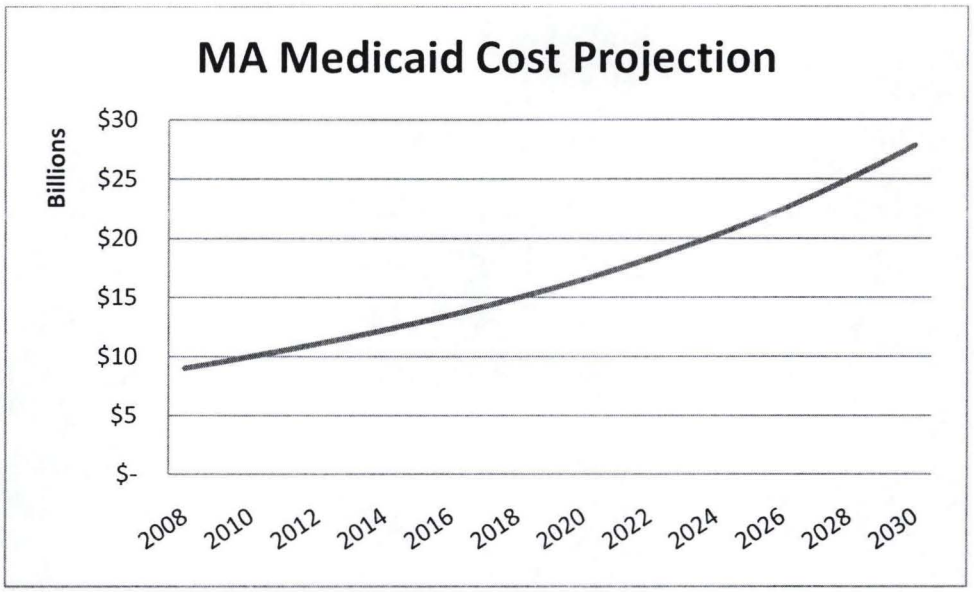

MA Groups by Eligible Months
6000000
5000000
4000000
3000000
2000000
1000000
0
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Adult
Child
Aged
Blnd/Dsbd


MA Groups by Cost
$4,000,000,000.00
$3,500,000,000.00
$3,000,000,000.00
$2,500,000,000.00
$2,000,000,000.00
$1,500,000,000.00
$1,000,000,000.00
$500,000,000.00
$-
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Adult
Child
Aged
Blnd/Dsbd

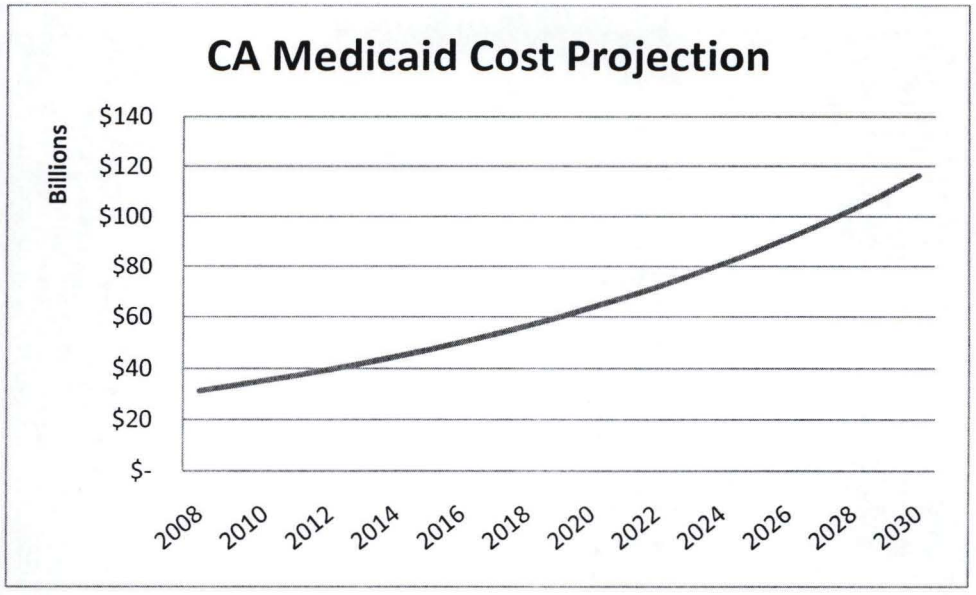

CA Groups by Eligible Months
45000000
40000000
35000000
30000000
25000000
20000000
15000000
10000000
5000000
0
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Adult
Child
Aged
Blnd/Dsbd


CA Groups by Cost
$16,000,000,000.00
$14,000,000,000.00
$12,000,000,000.00
$10,000,000,000.00
$8,000,000,000.00
$6,000,000,000.00
$4,000,000,000.00
$2,000,000,000.00
$-
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Adult
Child
Aged
Blnd/Dsbd

Starting around $9 billion in 2008, Massachusetts's program is predicted to rise to almost $28 billion by 2030, growing 209% over the course of the projection with a 5.26% yearly total rate of growth.



California's program is larger to begin with due in large part to having a much greater general population than Massachusetts. An estimated $31.3 billion in 2008, the program will be anticipated to cost around $116.3 billion by 2030. This is 272% growth with an average yearly rate of 6.15%. What sets these values apart from those of Massachusetts is the impact of the estimated population growth in California.



The projection estimates that between 2014 and 2019, the phase in period for changes to the Medicaid program under the PPACA, total spending for Massachusetts will be $83,522 million and $311,634 million for California without any legislative change. If the rates of increased spending due to health care reform are correct, then the total spending in these years will actually be between $84,107 million and $85,025 million for Massachusetts and between $349,965 million and $360,872 million for California, an increase by as much as $1,503 million for Massachusetts and $49,238 million for California.

Conclusion

Despite not getting much attention forty-five years ago, the Medicaid program has consistently outgrown expectations in terms of cost. While mounting health care costs in general could easily be made the culprit of this trend, much credit must be given to decisions made by the federal and state governments allowing enrollment and coverage to expand. The public perceives a large benefit for the medical needs to be met for those who cannot afford to meet those needs themselves. This continues today in the positive view of Medicaid's role and quality of benefits with respect to other governmental programs, as the program will absorb many of the nation's currently uninsured through recent legislation to take effect in 2014.

Given Medicaid's significant role in society, many groups have conducted studies to project the costs of the program into the future at both a state and federal level. They have used various sources of data, assumptions, and methods which I have attempted to summarize in this work. To create my own model that could take any state's data and generate a projection through 2030, I pulled from these various studies the data that could be easily accessed, as well as reasonable assumptions and methods to be used given the scope of this study.

The application of the model constructed to two different states allowed for comparison given the differing nature of their programs. Despite similar expected rates of cost growth, California's large rate of population growth in comparison to Massachusetts led to its projection greatly outpacing Massachusetts's in growth over the next twenty years. Also, since Massachusetts already provides coverage for much of its population that Medicaid is to expand enrollment to, the state will see little relative change under the landmark health reform that will greatly impact states such as California.

As with the projections studied, the model created for this work has limitations in accuracy due to assumptions that must be made based on historical data. While one cannot with certainty say the California Medicaid program will cost $116.3 billion in 2030, creating a projection with data available is still beneficial for those in charge of the program. Before putting to law a change with large ramifications, they know reasonably where the program will be in twenty years if no change is made at all. In the process of studying forecasting and creating a forecast model, I have to come to understand the inherent difficulty of the work and the importance of communicating that these results are meant to guide decisions, not to be expected with a high degree of certainty.

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